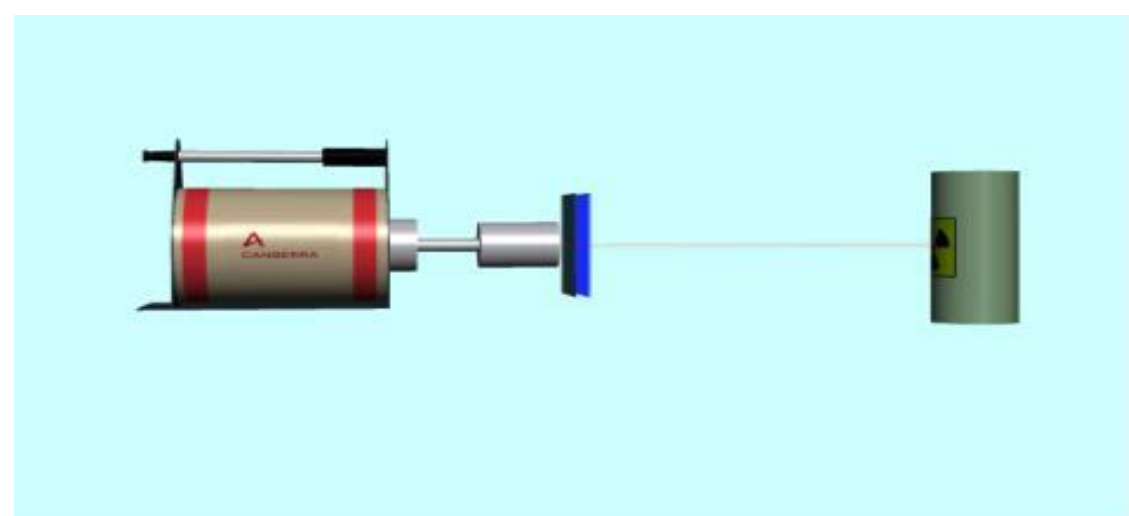


Nucleonica Training Course 18-19 April 2013

Nikolaos Stefanakis (PhD)

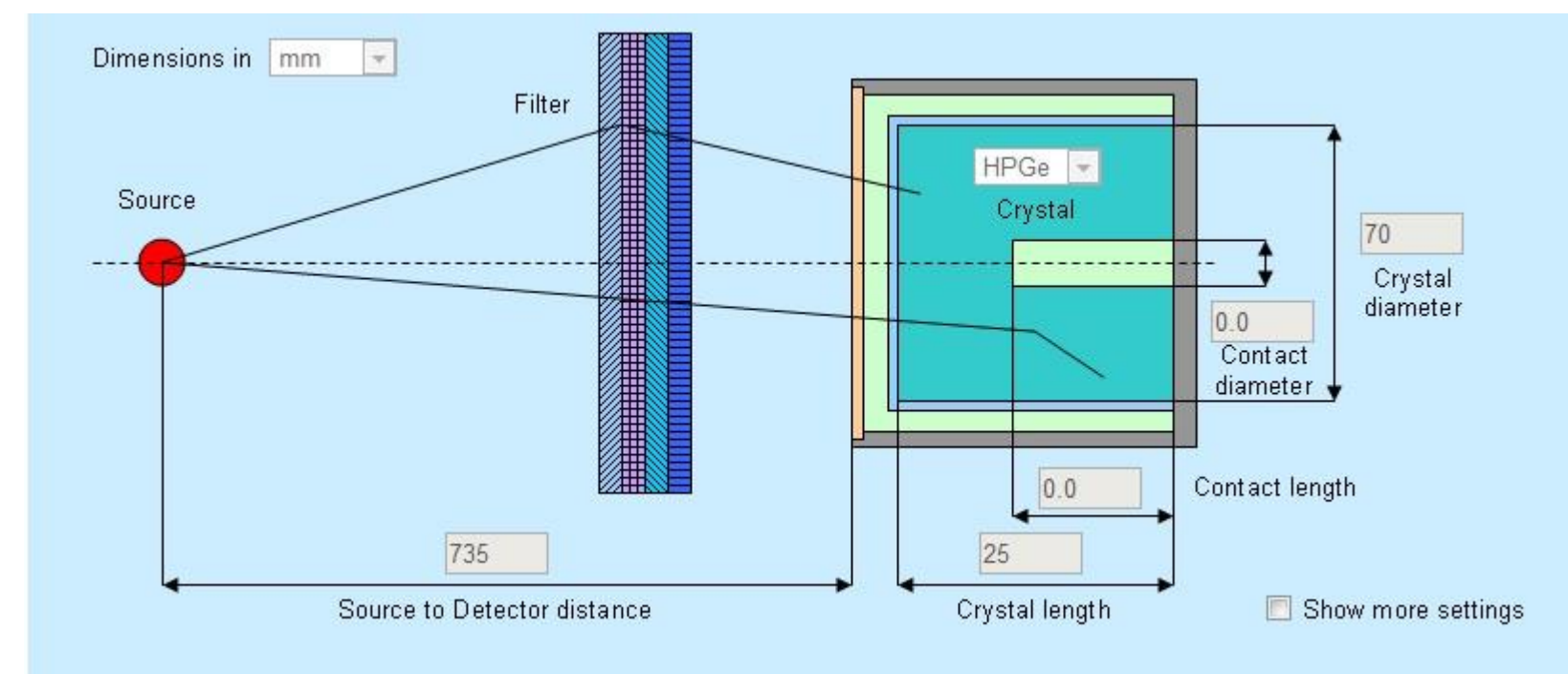
A comparison of a measurement using the Canberra BEGe Detector and a simulation using nucleonica

Parameters for the measurement of waste sample using the Canberra detector



- Waste sample: 5l Cardboard tube containing ca. 2g Neptunium powder. It can be considered as a point source
- Canberra BEGe Detector Model BE3825 (25mm x 38cm²)
- Source to detector distance 665 mm
- 0,5 mm Cadmium Filter (Cd)+ 4mm Aluminium Filter
- Measurement time 1200 sec

Parameters for the simulation using nucleonica Gamma Spectrum Generator (GSG)



- 2 g Np-237
- BEGe Detector (25mm x 38cm²)
- Source to detector distance 735 mm
- 0.5mm Cooper + 4mm Aluminium filter (There is no Cd!)
- Measurement time 1200 sec
- Include gamma-rays of daughter nuclides
- Consider backscatter radiation
- Simulate natural gamma-ray background (The count rates were partly calculated by Karl-Heinz Nelges)

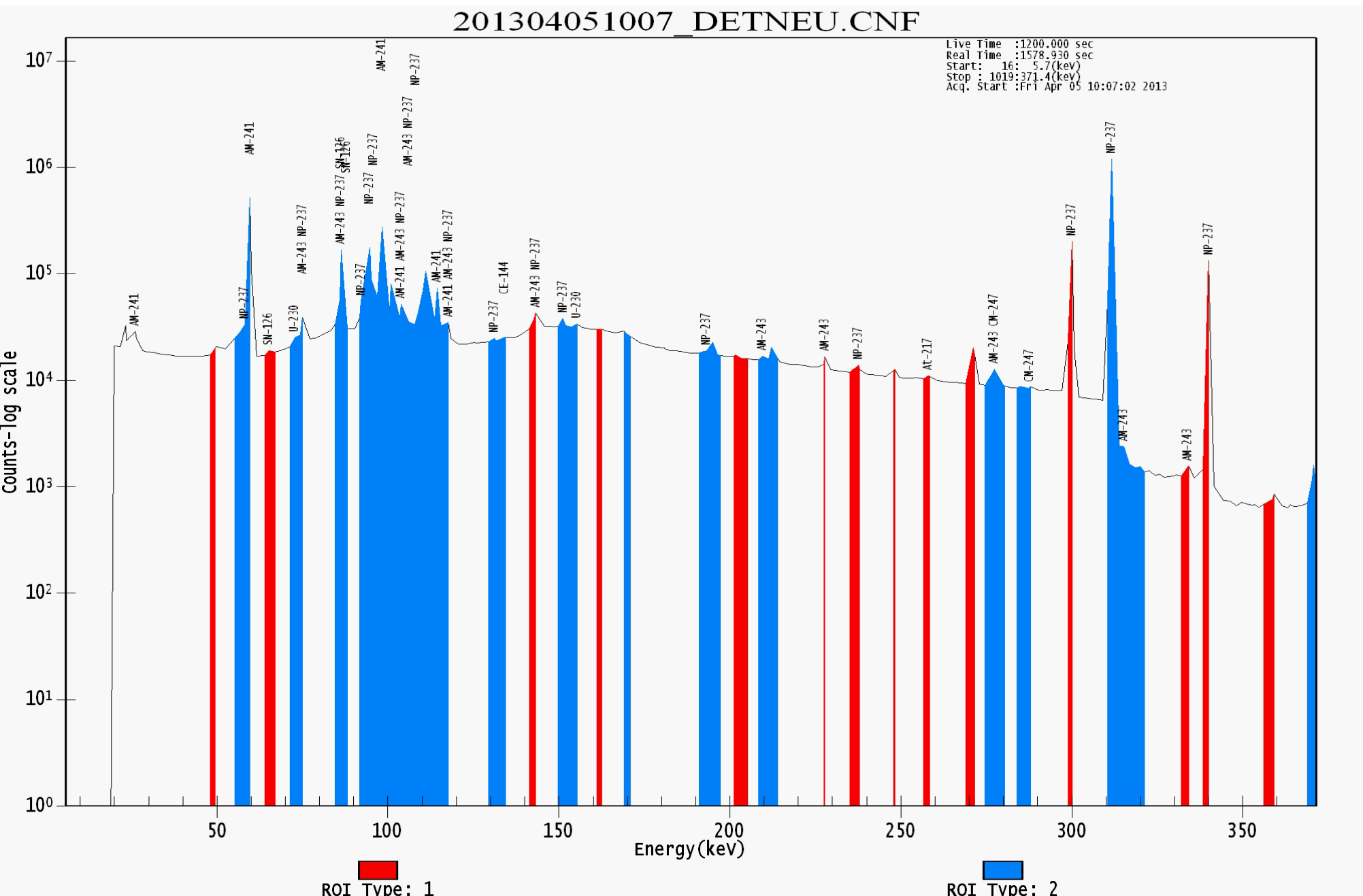
Genie 2000 Evaluation Results

***** INTERFERENCE CORRECTED REPORT *****

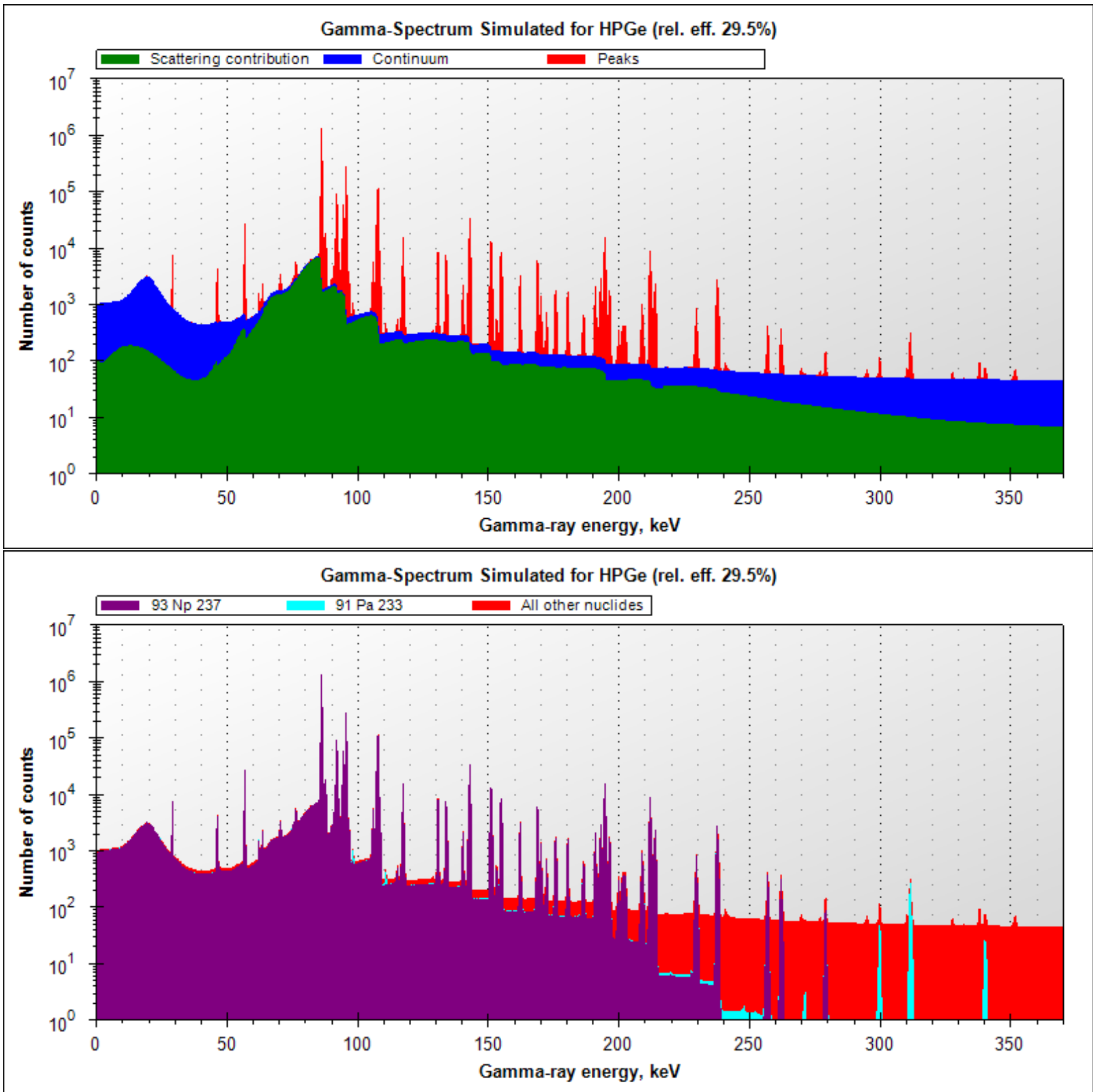
Sample Identification: 9576
Nuclide Library Used: D:\GENIE2K\CAMFILES\Faesie_nl.NLB
Identification Energy Tolerance : 1.000 keV

Nuclide Name	Nuclide Id	Wt mean Confidence	Wt mean Activity (Bq)	Wt mean Activity Uncertainty	MDA (Bq)
K-40		0.976	3.06E+04	10.50 %	< 6.79E+03
SN-126		0.964	3.08E+04	25.43 %	< 2.51E+04
CS-137	0	0.949	2.14E+04	6.84 %	< 1.32E+03
CE-144		0.791	6.03E+04	47.27 %	< 0.00E+00
X EU-155		0.958			
At-217		0.988	1.36E+08	21.60 %	< 7.20E+07
X Th-226		0.592			
X Th-229		0.402			
U-230		0.509	1.99E+07	10.36 %	< 3.13E+06
X PA-234		0.325			
NF-237	0	0.970	3.44E+07	3.36 %	< 7.08E+03
X U-238		0.434			
AM-241	0	0.998	1.37E+08	13.53 %	< 1.24E+05
AM-243	0	0.985	4.82E+05	4.39 %	< 1.06E+04
X CM-243		0.693			
CM-247	0	0.862			< 2.39E+03

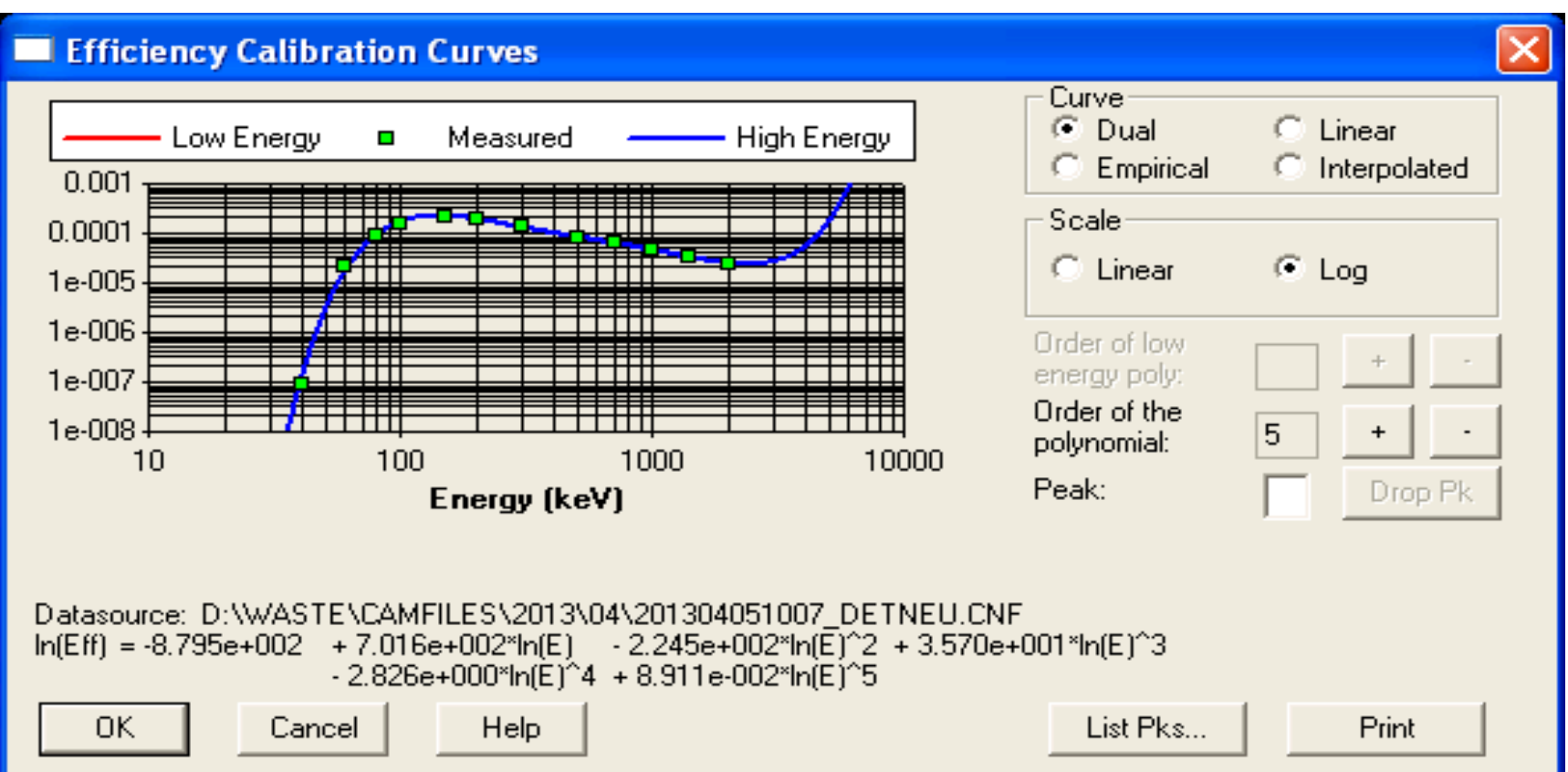
Measured Spectrum with Canberra BEGe Detector



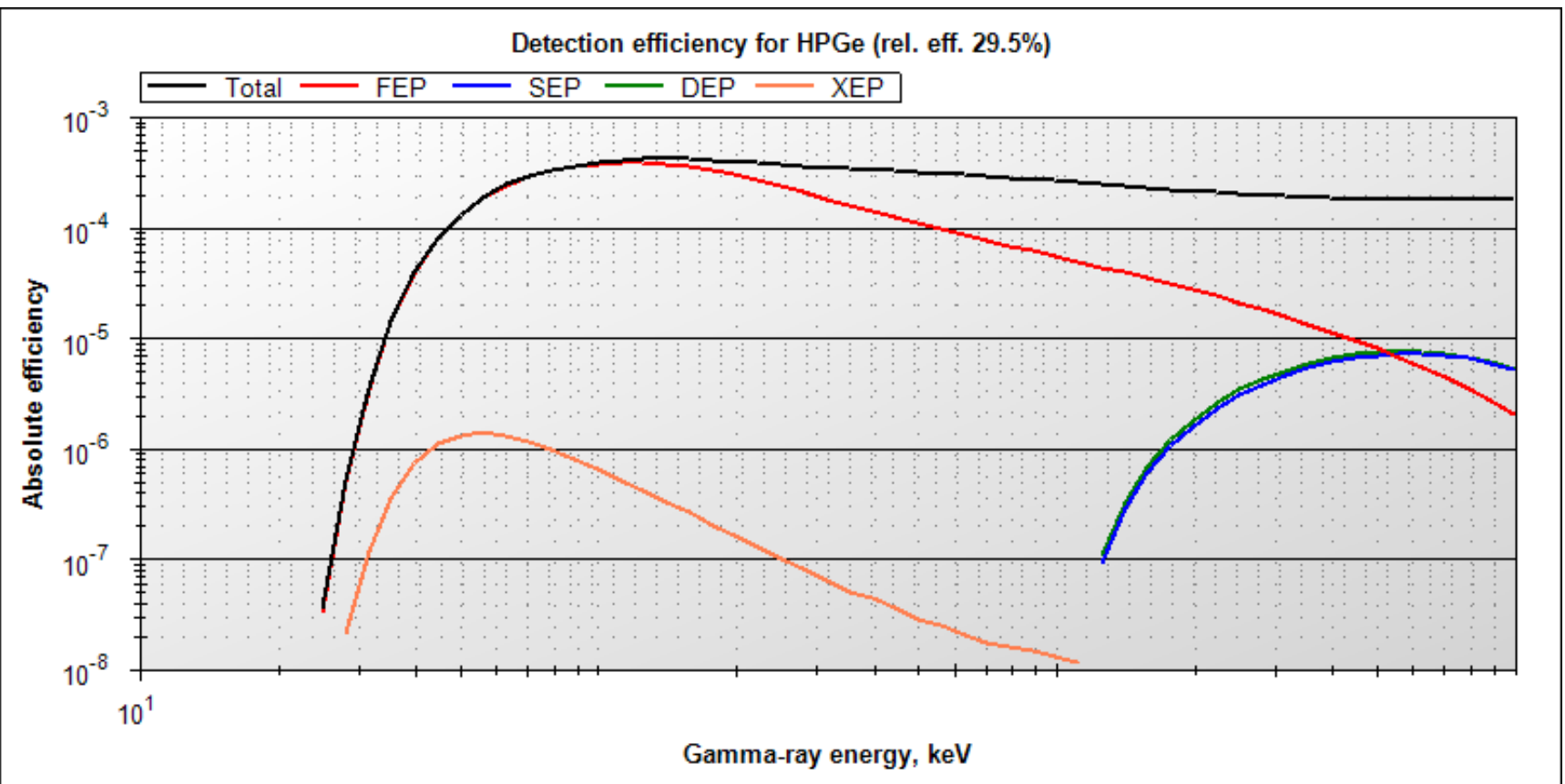
Simulated spectrum with nucleonica Gamma Spectrum Generator



Detection efficiency using the Canberra Geometry composer with isocs (In Situ Object Counting System)



Detection efficiency with nucleonica



- The calculated efficiency using nucleonica fits exactly the efficiency calculated with the Canberra Geometry composer

Reasons for the small deviation in the Spectrum between measurement and simulation

- An extended 5l paper tube source was measured that contains 2g Np and small amounts of other radiation sources as well, but a point source was simulated in nucleonica
- Cu filter was used in the simulation instead of Cd (There is no Cd in nucleonica)
- The continuum contribution due to the summation peak of Np-237 at 311keV can not be taken into account in the simulation

Thanks!

I am grateful to our project coordinator Dr. Nicole Rausch (jrc-itu) for many valuable discussions and support. It was her idea the comparison between the measurement and the simulation using nucleonica. I wish also to thank Dr. Joseph Magill, Mr. Amadeus Vollmer, and Mr. Ulf Jacobson for useful discussions. Measurement data collected at the Measurement Laboratory JRC-ITU and published by courtesy of ITU for training purpose. I would like to thank Mr. Sadulla Altiparmak for performing the measurements and all colleagues at JRC-ITU for always being helpful, friendly and cooperative. In the end my deepest gratitude belongs to those friends and colleagues who encouraged me participating to the course and provided the required support.